May 1995 Highlights of the Light Ion Inertial Confinement Fusion Program

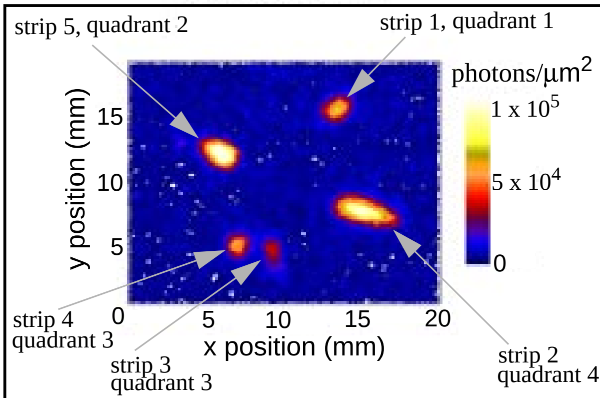

Image of ion-induced K_α x-rays on PBFA-II Shot 6569 from Ti strips at different azimuthal locations around the cylindrical target. Three strips extend from the bottom to 1.6 mm above the 4-mm-tall cylinder. Strips 1 and 4 were shortened to increase beam intensity on target and show only beam above the target.

The ICF program at Sandia is evolving from a structure that emphasizes beam intensity and hohlraum targets driven by a radially focusing (barrel) diode on PBFA II to a new structure that better supports our current role within the National ICF Program. The new structure emphasizes contributions to the high yield target data base, the National Ignition Facility, and ion beam generation and transport and pulsed power technology for high yield. Where appropriate, new objectives are being added and objectives that do not support the present national strategy are being removed or postponed. As part of the new structure, we are modifying PBFA II to allow ion beam generation and focusing in an extraction, or axially focusing, mode (PBFA X) and hohlraum physics studies using x rays from an imploding z pinch (PBFA Z). The extraction hardware will be installed in June.

On recent PBFA-II shots the anode was heated to 450°C and RF components were operated at 500 W (previously, these components failed at 200 W). A new regime of operation is obtained by heating and cleaning: protons are emitted earlier in time from the lithium-rich surface. The Ti gettering pump to prevent surface recontamination is not yet operational and is no longer being developed; this capability is not needed for PBFA X, which will use differential pumping instead.

Analysis of the FY93 and FY94 target series shows the lithium beam may have been overfocused--i.e., focused ~1 cm in front of the target--thus reducing the energy reaching the target. The Ti strips in the FY94 shots provide more information about beam variation (see figure) than a single quadrant measurement would. Each gives the vertical beam profile at a specific azimuth, allowing determination of vertical focus, vertical width, and azimuthal symmetry. The intensity about the target midplane varies a factor of 2 to 3, and the degree of asymmetry worsens as average intensity increases. The average intensity on a flat Ti strip looking at a 60° sector ranges from 0.8 - 1.1 TW/cm^2. The peak intensity in time, averaged over the sides of the 4-mm-dia hohlraum, ranges from 1.3 - 2.1 TW/cm^2. Cleaning the bottom cathodes between shots correlates with improved shot-to-shot reproducibility during the FY94 target series as compared to FY93. Eliminating vacuum transport near the target may also have reduced beam variability.

An EMFAPS (Evaporating Metal Foil Anode Plasma Source) anode is ready for SABRE testing. EMFAPS may provide a thin, dense lithium layer of higher purity than a passive source. Accelerator current, diverted by a plasma opening switch, will resistively heat a metal film containing lithium. The first design to be tested consists of a Mo resistive heater film, overcoated with an LiF layer, and an epoxy insulating layer. Electrical breakdown of the emitted lithium vapor should occur 2-5 ns after reaching 1-10 torr vapor pressures. In Cornell experiments, LiF film layers produce beams composed of 60% lithium.

Contact: Jeff Quintenz, Inertial Confinement Fusion Program, Dept. 9502, 505-845-7245, fax: 505-845-7464, email: jpquint@sandia.gov
Highlights are prepared by Mary Ann Sweeney, Dept. 9541, 505-845-7307, fax: 505-845-7890, email: masween@sandia.gov.
Archived copies of the *Highlights* beginning July 1993 are available at http://www.sandia.gov/pulspowr/hedicf/highlights.